Amendments to the Claims

Listing of the Claims

Claims 1-17 (Previously Canceled)

Claim 18 (Previously presented): A node device which is used in an optical network system for transferring a user packet input from outside said optical network system to outside said optical network system through a plurality of said node devices, which are provided for making an optical path on a transfer route and which functioning as a start point node device, and an end point node device, an intermediate point node having an optical path to be set in said optical network system device between the start and end point node devices, respectively, the node device comprising:

a router,

an optical switch, and

a node control device, said node control device including a connection information responding means, and an optical path setting means;

said connection information responding means, when said optical network system has sequentially provided therein a first node device, a second node device, a third node device, and a fourth node device and when said connection information responding means belongs to said second node device:

inquiring said third node device adjacent to said second node device about connection information of said third node device and connection information of said fourth node device adjacent to said third node device each time a predetermined time is elapsed or a

predetermined event is generated, and storing the connection information of said third node device and the connection information of said fourth node device; and

responding with connection information of said second node device and connection information of said first node device adjacent to said second node device if said second node device receives inquiring about the connection information thereof and the connection information of said first node device; and

said optical path setting means, when said second node device functions as said intermediate node device, setting an optical path in said second node device without going through the router included therein based on the connection information of each of said third and fourth node devices acquired using said connection information responding means.

Claim 19 (Previously presented): The node device according to Claim 18, further comprising:

an optical path determination means for determining the necessity of a cut-through in said optical path setting means;

said optical path determination means, when said second node device functions as said start point node device and when said first, third, and fourth node devices function as said intermediate node devices, respectively:

determining the necessity of the setting of an optical path which does not go through the router belonging to any one of said first, third, and fourth node devices based on the connection information of each of said first, third, and fourth node devices, stored by said connection information responding means of said second node device, and

instructing the setting of said optical path to any one of said intermediate node

devices which correspond to said first, third, and fourth node devices, respectively, and for which the setting of said optical path is determined as necessary.

Claim 20 (Previously presented): The node device according to Claim 18, further comprising:

an information channel insuring means for determining whether any one of said intermediate node devices which correspond to said first, third, and fourth node devices, respectively, and for which the setting of said optical path is required, can insure the information channel even after the setting of said optical path, and setting said optical path only when said information channel can be insured.

Claim 21 (Previously presented): The node device according to Claim 18, further comprising:

an optical cross-connect having provided therein said optical switches for extracting optical signals from an optical fiber, inserting optical signals into an optical fiber, and setting optical paths between input/output optical fibers;

said router receiving a user packet and determining an output destination of said user packet based on header information of upper layer of said user packet; and

said node control device switching a route of the optical paths using the optical switches of said optical cross-connect according to instructions of the received user packet or based on self judgment by said node control device itself.

Claim 22 (Previously presented): The node device according to Claim 21, wherein said optical switch connects a destination-based buffer to at least one output port of the router to said optical

cross-connect, and for connecting a user packet read from said destination based buffer to an input port of said optical cross-connect.

Claim 23 (Previously presented): The node device according to Claim 22, wherein said router includes an allowable delay recognition function means for determining the allowable delay of a user packet for direct output of said user packet to one of the optical cross-connect and destination-based buffer according to one of the allowable delay and a packet loss ratio.

Claim 24 (Previously presented): The node device according to Claim 21, further comprising:

an optical path extraction/insertion means provided in said optical cross-connect for an information channel for alternatively extracting optical signals with a fixed wavelength insured for the information channel from the optical fiber, or for inserting said optical signals with a fixed wavelength into the optical fiber for communicating information signals with another node device.

Claim 25 (Previously presented): The node device according to Claim 21, further comprising:

a pilot tone signal super-imposing/receiving means for one of super-imposing pilot tone signals for an information channel on an optical path for user data, and separating pilot tone signals for the information channel from the optical path for communicating information signals with another node device.

Claim 26 (Previously Cancelled)

Claim 27 (Previously Cancelled)

Claim 28 (Previously presented): An optical path setting method for an optical network system for transferring a user packet input from outside said optical network system to outside said optical network system through a plurality of node devices, which are sequentially provided for making an optical path on a transfer route and which function as a start point node device, an end point node device, an intermediate point node device between the start point node and the end point node devices, respectively, each of said node devices comprising a router, an optical switch, and a node control device, and said node control device including a connection information responding means, and an optical path setting means, the method comprising the steps of:

when said optical network system has sequentially provided therein a first node device, a second node device, a third node device, and a fourth node device and when said connection information responding means belongs to said second node device,

said connection information responding means, when said node device functions as said second device,

inquiring said third node device adjacent to said second node device about connection information of said third node device and connection information of said fourth node device adjacent to said third node device each time a predetermined time is elapsed or a predetermined event is generated, and storing the connection information of said third node device and the connection information of said fourth node device, and

responding with connection information of said second node device and

connection information of said first node device adjacent to said second node device if said second node device receives inquiries about the connection information thereof and the connection information of said first node device; and

said optical path setting means, when said second node device functions as said intermediate node device, setting an optical path in said second node device without going through the router included therein based on the connection information of each of said third and fourth node devices acquired using said connection information responding means.

Claim 29 (Previously presented): The optical path setting method according to Claim 28, wherein said node control device further comprises an information channel insuring means, the method comprising the steps of:

said information channel insuring means:

determining whether any one of said intermediate node devices which correspond to said first, third and fourth node devices, respectively and for which the setting of the optical path is requested can insure the information channel even after the setting of the optical path, and

setting said optical path only when said information channel can be insured.

Claim 30 (Previously presented): The optical path setting method according to Claim 28, further comprising the steps of:

reading a packet from the destination-based buffer provided between said router and said optical switch; and

transmitting the packet to the optical path set by said optical path setting means.

Claim 31 (Previously presented): The optical path setting method according to Claim 30, further comprising the step of:

storing the packets in said destination-based buffer based on one of an allowable delay time and a packet loss ratio.

Claim 32 (Previously presented): The optical path setting method according to Claim 28, further comprising the steps of:

communicating between the node devices where the optical path is set; and

using optical signals with a wavelength insured for an information channel after said optical path is set.

Claim 33 (Previously presented): The optical path setting method according to Claim 32, further comprising the steps of:

communicating between the node devices where the optical path is set; and

super-imposing pilot tone signals for an information channel on the optical path for user data even if said optical path is set.

Claim 34 (Previously Cancelled).

Claim 35 (Previously presented): A node device in an optical network system including a first node device, a second node device connected thereto through an optical fiber, and a third node device connected thereto through an optical fiber, the node device functioning as said second

node device transferring a user packet input from outside said optical network system to said third node device through said second node device, each of said node devices comprising:

a router, an optical switch, and a node control device;

said node control device including a connection information responding means, and an optical path setting means,

said connection information responding means inquiring of said third node device adjacent to said second node device about connection information of said third node device and connection information of another node device adjacent to said third node device each time a predetermined time is elapsed or a predetermined event is generated, and storing the connection information of said third node device and the connection information of said another node device as a network connection information; and

said optical path setting means setting an optical path from said first node device to said third node device through said second node device without going through the router included therein based on said network connection information acquired using said connection information responding means.

Claim 36 (New): A node device for use in an optical network system which transfers a user packet across an optical path, said optical network system including a plurality of node devices directly or indirectly connected by optical fibers, each of said node devices comprising:

a router:

an optical cross-connect coupled to said router: and

a node control device coupled to said router and said optical cross-connect, said node control device including:

a connection information response part; and

an optical path setting part,

wherein the connection information response part of each node device:

(1) exchanges connection information with each adjacent node device to which it is directly coupled by an optical fiber; and

(2) receives connection information from and transmits connection information to each node device to which it is not directly coupled by an optical fiber, said connection information being received and provided to each node device via an adjacent node device to which it is directly coupled, whereby each of the plurality of node devices contains all of the connection information; and

wherein, when a user packet is inputted to a given node device, the optical path setting part of said given node device:

(1) determines, based on an analysis of the user packet provide by the router of said given node device, a preferred path to the destination of the packet based on the connection information stored in said given node device; and

(2) requests the node devices located along said preferred path to set said preferred path.

Claim 37 (New): The node device according to claim 36, wherein the connection information response part of said node control device initiates an exchange of information with each

adjacent node device after a predetermined time elapses or after a predetermined event has been generated.

Claim 38 (New): The node device according to claim 36, wherein said node control device further comprises a cut-through optical path necessary/unnecessary determination part, said necessary/unnecessary determination part determining the necessity of establishing a cut-through optical path before the optical setting part of said given node device determines a preferred path to the destination of the packet, and selectively sets the cut-through optical path only when it is necessary.

Claim 39 (New): The node device according to claim 36, further comprising:

a plurality of destination-based buffers coupled between said router and a switch function part, at least one of said plurality of destination-based buffers stores user packets received from at least one user terminal, and when a predetermined number of said user packets are stored in said at least one destination-based buffer, said optical path setting part establishes a cut-through path from the node device to a destination node device,

said at least one destination-based buffer transfers said user packets to said switch function part, which transmits said user packets to said cut-through path, and when all of said user packets have been transmitted from said at least one destination-based buffer across said cut-through path, said cut-through path is released and a different cut-through path is established to transmit user packets stored in a different one of said plurality of destination-based buffers.

Claim 40 (New): The node device according to claim 39, further comprising:

an allowable delay recognition part coupled to said router, said allowable delay recognition part determines if said user packets are for a real-time application or a non-real-time application, and at least one of said plurality of destination-based buffers stores said user packets if said allowable delay recognition part determines said user packets are for a non-real-time application.

Claim 41 (New): The node device according to claim 39, wherein said plurality of destination-based buffers are classified according to quality classes of said user packets.

Claim 42 (New): The node device according to claim 36, said node control device further comprising:

an information channel insuring part included in the node control device that insures an optical path will be set as an information channel between the node device and at least one adjacent node device, said information channel carries control signals between the node device and said at least one adjacent node device.

Claim 43 (New): The node device according to claim 42, wherein the node control device establishes a cut-through optical path after said information channel insuring part determines that said information channel will be available after setting said cut-through optical path.

Claim 44 (New): The node device according to claim 36, said node control device further comprising:

a pilot tone signal transmission part adding a pilot tone signal as an information channel to a cut-through optical path, said pilot tone signal transmission part transmits said pilot tone signal containing control information between the node device and at least one adjacent node device.

Claim 45 (New): The node device according to claim 44, wherein the node device transmits an acknowledgement (ACK) signal after receiving said pilot tone signal.

Claim 46 (New): The node device according to claim 44, wherein pilot tone signals from a plurality of node devices on said cut-through optical path are time division multiplexed to prevent collisions between said pilot tone signals.

Claim 47 (New): The node device according to claim 36, wherein said node device allocates a dedicated optical path as an information channel, said dedicated optical path uses a dedicated optical wavelength.

Claim 48 (New): An optical network system for transferring a user packet across an optical path, said optical network system including a plurality of node devices directly or indirectly connected by optical fibers, each of said node devices comprising:

a router:

an optical cross-connect coupled to said router: and

a node control device coupled to said router and said optical cross-connect, said node control device including:

a connection information response part; and

an optical path setting part,

wherein the connection information response part of each node device:

(1) exchanges connection information with each adjacent node device to which it is directly coupled by an optical fiber; and

(2) receives connection information from and transmits connection information to each node device to which it is not directly coupled by an optical fiber, said connection information being received and provided to each node device via an adjacent node device to which it is directly coupled, whereby each of the plurality of node devices contains all of the connection information; and

wherein, when a user packet is inputted to a given node device, the optical path setting part of said given node device:

(1) determines, based on an analysis of the user packet provide by the router of said given node device, a preferred path to the destination of the packet based on the connection information stored in said given node device; and

(2) requests the node devices located along said preferred path to set said preferred path.